

## Adaptive Flight Envelope Estimation and Protection, Phase I

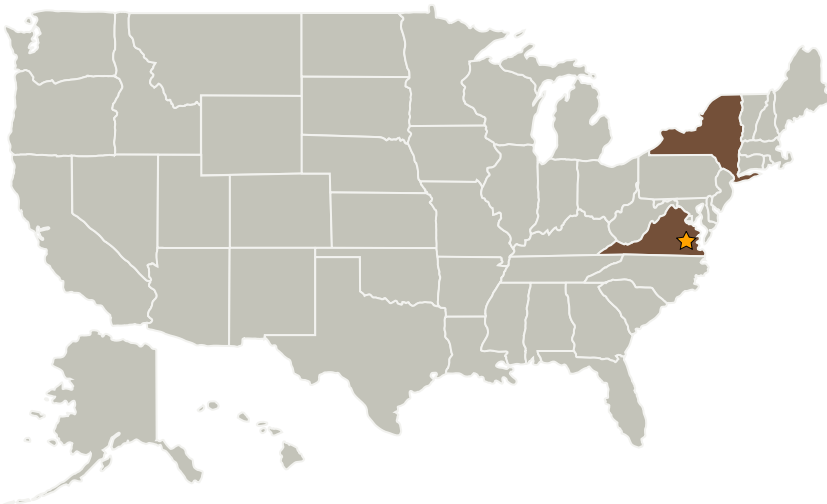
Completed Technology Project (2009 - 2009)



## Project Introduction

Impact Technologies, in collaboration with the Georgia Institute of Technology, proposes to develop and demonstrate an innovative flight envelope estimation and protection system for aircraft under damage upset conditions or severe flight variations. Through the integration of advanced fault detection (IVHM) algorithms, real-time system identification of the damage/faulted aircraft and flight envelop mapping, real-time decision support can be executed autonomously for improving damage tolerance and flight recoverability. The core tasks to complete of this proposed workscope include: 1) Development of a strong-tracking health identification algorithm for assessing the dynamics and performance limitation of impaired aircraft; 2) Development of the adaptive flight envelope estimation process; 3) Development of the envelope protection algorithm based on adaptive neural networks that can learn the generated online dynamic models; and 4) Demonstration of the proposed technologies under realistic flight control actuator and propulsion fault conditions. A core innovation of this program is the use of the on-line, adaptive learning neural networks that are capable of generating the dynamic models and operational envelop in real-time, which can then be used to estimate limits on the controller commands while preventing envelope exceedances. The developed techniques will be demonstrated in Phase I using an integrated aircraft model that uses the NASA MAPSS propulsion model and Generic Transport Model (GTM), with eventual demonstration using the NASA Flight Simulator at NASA Langley.

## Primary U.S. Work Locations and Key Partners



Adaptive Flight Envelope  
Estimation and Protection,  
Phase I

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Organizational  
Responsibility**Responsible Mission  
Directorate:**

Space Technology Mission  
Directorate (STMD)

**Lead Center / Facility:**

Langley Research Center (LaRC)

**Responsible Program:**

Small Business Innovation  
Research/Small Business Tech  
Transfer

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| Organizations Performing Work   | Role                    | Type        | Location            |
|---------------------------------|-------------------------|-------------|---------------------|
| ★ Langley Research Center(LaRC) | Lead Organization       | NASA Center | Hampton, Virginia   |
| Impact Technologies, LLC        | Supporting Organization | Industry    | Rochester, New York |

## Primary U.S. Work Locations

|          |          |
|----------|----------|
| New York | Virginia |
|----------|----------|

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX10 Autonomous Systems
  - └ TX10.2 Reasoning and Acting
    - └ TX10.2.6 Fault Response